

U.S. Patent Application Serial No. 10/574,832
Response filed August 17, 2009
Reply to OA dated April 15, 2009

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (original): A mixture of at least two amide-based compounds represented by General Formula (1):

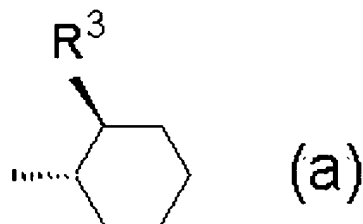


wherein

a represents an integer of 2 to 6,

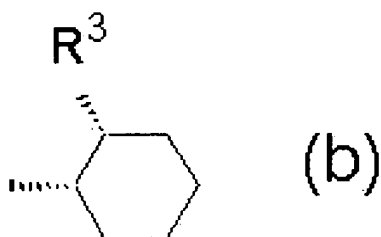
R^1 represents a C_{2-30} saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valency of 2 to 6, and

the two to six R^2 groups are the same or different, and each represent a trans-2-alkylcyclohexylamine residue represented by General Formula (a):



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wherein R^3 represents a C_{1-10} linear or branched alkyl group, or a cis-2-alkylcyclohexylamine residue represented by General Formula (b):



wherein R^3 represents a C_{1-10} linear or branched alkyl group,

the trans-2-alkylcyclohexylamine residue represented by General Formula (a) being present in a proportion of at least 70 mole % but less than 100 mole % of the total 2-alkylcyclohexylamine residues in the mixture.

Claim 2 (original): A mixture according to Claim 1, wherein the trans-2-alkylcyclohexylamine residue represented by General Formula (a) is present in a proportion of at least 71.9 mole % but less than 100 mole % of the total 2-alkylcyclohexylamine residues in the mixture.

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Claim 3 (original): A mixture according to Claim 1, wherein R^3 is a C_{1-6} linear or branched alkyl group.

Claim 4 (original): A mixture according to Claim 1, wherein R^3 is methyl.

Claim 5 (original): A mixture according to Claim 1, wherein R^1 is a 1,2,3-propanetricarboxylic acid residue or a 1,2,3,4-butanetetracarboxylic acid residue.

Claim 6 (original): A mixture according to Claim 1, wherein R^1 is a 1,2,3-propanetricarboxylic acid residue, and the mixture has a trans 2-alkylcyclohexylamine residue absorbance proportion (Ctrans) of at least 56.3% but less than 72.0% as defined by equation (E):

$$C_{trans} (\%) = [A_{trans} / (A_{trans} + A_{cis})] \times 100 \quad (E)$$

wherein

A_{trans} represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the trans-2-alkylcyclohexylamine residue represented by General Formula (a) of the corresponding all-trans amide-based compound appears, and

A_{cis} represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform

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Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the cis-2-alkylcyclohexylamine residue represented by General Formula (b) of the corresponding all-cis amide-based compound appears.

Claim 7 (original): A mixture according to Claim 1, wherein R¹ is a 1,2,3,4-butanetetracarboxylic acid residue, and the mixture has a trans 2-alkylcyclohexylamine residue absorbance proportion (Ctrans) of at least 58.8% but less than 71.5% as defined by equation (E):

$$\text{Ctrans (\%)} = [\text{Atrans}/(\text{Atrans} + \text{Acis})] \times 100 \quad (\text{E})$$

wherein

Atrans represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the trans-2-alkylcyclohexylamine residue represented by General Formula (a) of the corresponding all-trans amide-based compound appears, and

Acis represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the cis-2-alkylcyclohexylamine residue represented by General Formula (b) of the corresponding all-cis amide-based compound appears.

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Claim 8 (withdrawn): An amide-based compound represented by General Formula (1):

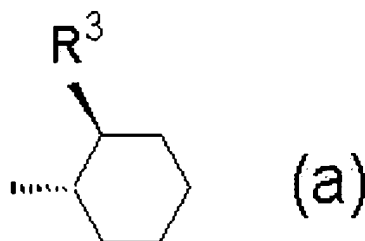


wherein

a represents an integer of 2 to 6,

R^1 represents a C_{2-30} saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valence of 2 to 6, and

the two to six R^2 groups are the same, and represent a trans-2-alkylcyclohexylamine residue represented by General Formula (a):



wherein R^3 represents a C_{1-10} linear or branched alkyl group.

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Claim 9 (withdrawn): An amide-based compound according to Claim 8, wherein R^3 is a C_{1-6} linear or branched alkyl group.

Claim 10 (withdrawn): An amide-based compound according to Claim 8, wherein R^3 is methyl.

Claim 11 (withdrawn): An amide-based compound according to Claim 8, wherein R^1 is a 1,2,3-propanetricarboxylic acid residue or a 1,2,3,4-butanetetracarboxylic acid residue.

Claim 12 (withdrawn): An amide-based compound according to Claim 8, wherein R^1 is a 1,2,3,4-butanetetracarboxylic acid residue and R^3 is methyl.

Claim 13 (withdrawn): An amide-based compound according to Claim 8, wherein R^1 is a 1,2,3-propanetricarboxylic acid residue and R^3 is methyl.

Claim 14 (withdrawn): A polyolefin resin nucleating agent comprising the mixture according to Claim 1.

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Claim 15 (withdrawn): A polyolefin resin nucleating agent comprising the amide-based compound according to Claim 8.

Claim 16 (withdrawn): A polyolefin resin composition comprising a polyolefin resin and a mixture according to Claim 1.

Claim 17 (withdrawn): A polyolefin resin composition according to Claim 16, wherein the composition contains 0.01 to 10 parts by weight of the mixture.

Claim 18 (withdrawn): A polyolefin resin molded product obtainable by molding a polyolefin resin composition according to Claim 16.

Claim 19 (original): A process for producing a mixture of amide-based compounds represented by General Formula (1):



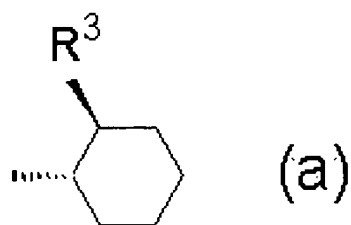
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wherein

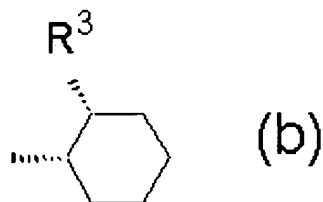
a represents an integer of 2 to 6,

R^1 represents a C_{2-30} saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valency of 2 to 6, and

the two to six R^2 groups are the same or different, and each represent a trans-2-alkylcyclohexylamine residue represented by General Formula (a):

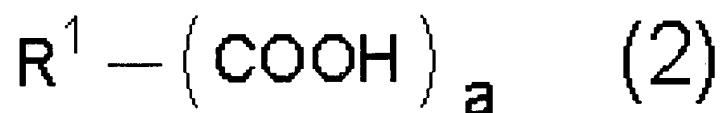


wherein R^3 represents a C_{1-10} linear or branched alkyl group, or a cis-2-alkylcyclohexylamine residue represented by General Formula (b):

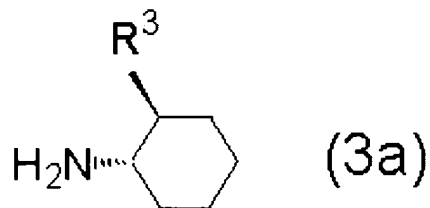


wherein R^3 represents a C_{1-10} linear or branched alkyl group, the trans-2-alkylcyclohexylamine residue represented by General Formula (a) being present in a proportion of at least 70 mole % but less than 100 mole % of the total 2-alkylcyclohexylamine residues in the mixture,

the process comprising subjecting, to amidation reaction, a polycarboxylic acid represented by General Formula (2):



wherein R^1 represents a C_{2-30} saturated or unsaturated aliphatic polycarboxylic acid residue, and a represents an integer of 2 to 6 or a reactive derivative thereof, and an amine mixture of (i) a trans-2-alkylcyclohexylamine represented by General Formula (3a):

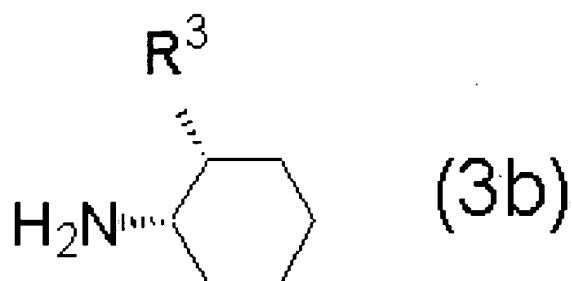


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wherein R^3 represents a C_{1-10} linear or branched alkyl group, and (ii) a cis-2-alkylcyclohexylamine represented by General Formula (3b)



wherein R^3 represents a C_{1-10} linear or branched alkyl group, the content of the trans-2-alkylcyclohexylamine in the amine mixture being at least 70% but less than 100% as determined by gas chromatography (GLC).

Claim 20 (withdrawn): A process for producing an amide-based compound represented by General Formula (1):



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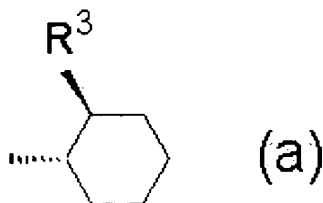
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wherein

a represents an integer of 2 to 6,

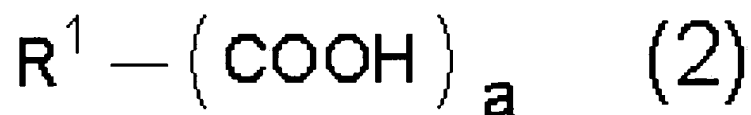
R^1 represents a C_{2-30} saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valency of 2 to 6, and

the two to six R^2 groups are the same and represent a trans-2-alkylcyclohexylamine residue represented by General Formula (a):



wherein R^3 represents a C_{1-10} linear or branched alkyl group,

the process comprising subjecting, to amidation reaction, a polycarboxylic acid represented by General Formula (2):

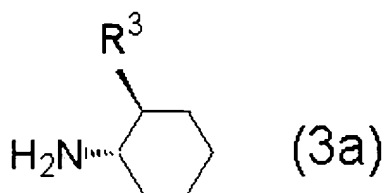


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wherein R^1 represents a C_{2-30} saturated or unsaturated aliphatic polycarboxylic acid residue, and a represents an integer of 2 to 6 or a reactive derivative thereof, and a trans-2-alkylcyclohexylamine represented by General Formula (3a):



wherein R^3 represents a C_{1-10} linear or branched alkyl group.

Claim 21 (withdrawn): A method for improving rigidity of a polyolefin resin molded product, the method comprising incorporating a mixture according to Claim 1.

Claim 22 (Currently Amended): ~~Use of~~ A method of using a mixture comprising at least two amide-based compounds, the method comprising incorporating a mixture according to Claim 1 into a polyolefin resin to improve ~~for improving~~ rigidity of a polyolefin resin molded product.

Claim 23 (withdrawn): Use of an amide-based compound according to claim 8 for improving rigidity of a polyolefin resin molded product.

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Claim 24 (withdrawn): A method for improving rigidity of a polyolefin resin molded product, the method comprising incorporating an amide-based compound accord to Claim 8 into a polyolefin resin to obtain a polyolefin resin composition, and molding the polyolefin resin composition.

Claim 25 (withdrawn): A polyolefin resin composition comprising a polyolefin resin and an amide-based compound according to Claim 8.

Claim 26 (withdrawn): A polyolefin resin composition according to Claim 25, wherein the composition contains 0.01 to 10 parts by weight of the amide-based compound.

Claim 27 (withdrawn): A polyolefin resin molded product obtainable by molding a polyolefin resin composition according to Claim 25.